

Informal document **VIAQ-02-08**

Proposal on Substances To Be Measured

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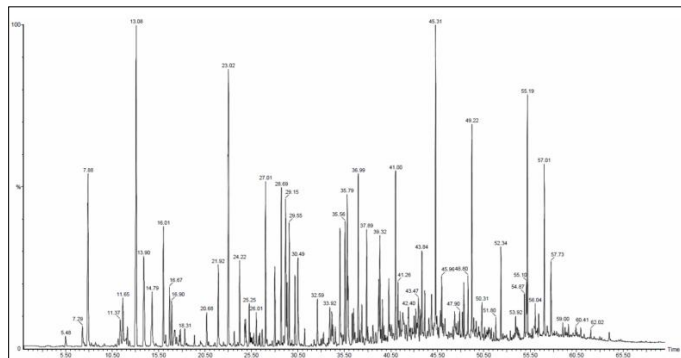
◆ What are VOCs?

- What are VOCs? "Volatile organic compound (VOC)" means any organic compound having an initial boiling point less than or equal to 250° C measured at a standard pressure of 101,3 kPa. (Directive 2004/42/CE of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products)
- World Health Organization (WHO) has classified VVOCs, VOCs and SVOCs based on ranges of boiling points

Description	Abbreviation	Boiling Point Range(°C)	Example Compounds
Very volatile (gaseous) organic compounds	VVOC	<0 to 50-100	Propane, butane, methyl chloride
Volatile organic compounds	VOC	50-100 to 240-260	Formaldehyde, d-Limonene, toluene, acetone, ethanol (ethyl alcohol) 2-propanol (isopropyl alcohol), hexanal
Semi volatile organic compounds	SVOC	240-260 to 380-400	Pesticides (DDT, chlordane, plasticizers (phthalates), fire retardants (PCBs, PBB))

◆ Identification of Volatile Organic Compounds

- Test vehicle cabin air measurement(ISO 12219-1 Ambient mode)



< Chromatogram of VOCs >

Nr	RT	RI	compund	CAS number	µg/m3
1	7.9	490	Aceton	67-64-1	71
2	11.6	598	2-Butanon	78-93-3	25
3	13.1	600	n-Hexan	110-54-3	164
4	13.9	625	Tetrahydrofuran	109-99-9	54
5	14.8	624	Methylcyclopentan	96-37-7	27
6	16.0	661	1-Butanol	71-36-3	41
7	21.9	777	N,N-Dimethylformamid	68-12-2	25
8	23.0	767	Toluol	108-88-3	162
9	24.2	798	Hexanal	66-25-1	22
10	27.0	900	C9-Alkan		42
11	28.0	900	C9-Alken		21
12	28.7	863	Ethylbenzol	100-41-4	49
13	29.2	871	m,p-Xylol	108-38-3 / 106-42-3	67
14	29.6	892	Cyclohexanon	108-94-1	40
15	30.2	891	Styrol	100-42-5	24
16	30.5	894	o-Xylol	95-47-6	29
17	33.9	985	Phenol	108-95-2	21
18	35.0	985	a-Methylstyrol	98-83-9	37
19	35.6	1028	Azoisobuttersäurenitril	78-67-1	45
20	35.8	998	1,2-Propandioldiacetat	623-84-7	33
21	37.0	1028	2-Ethyl-1-hexanol	104-76-7	44
22	37.9	1034	Limonen	138-86-3	31
23	39.3	1200	C12-Alkan		25
24	41.0	1100	n-Undecan	1120-21-4	39
25	43.5	1200	C12-Alkan		22
26	43.8	1200	C12-Alkan		21
27	45.3	1200	n-Dodecan	112-40-3	81
28	49.2	1300	Tridecan	629-50-5	43
29	55.2	1529	2,6-Di-tert-butyl-4-methylphenol	128-37-0	42

◆ The detection rates of Volatile Organic Compounds

- We tested 39 vehicles in 2006 for volatile organic compounds.
- This table shows the 24 substances and their detection rates.

No	Substances	Detection rates(%)
1	Toluene	100.0
2	Styrene	100.0
3	o-Xylene	100.0
4	m,p-Xylene	100.0
5	Ethylbenzene	100.0
6	Benzene	100.0
7	1,3,5-Trimethylbenzene	100.0
8	1,2,4-Trimethylbenzene	100.0
9	Trichloroethylene	57.5
10	Chloroform	20.0
11	Chlorobenzene	16.3
12	o-Dichlorobenzene	13.8
13	Carbon tetrachloride	5.0
14	1,1,1-Trichloroethane	5.0
15	m,p-Dichlorobenzene	4.4

◆ Comparison of VIAQ Substances Limits

CAS No.	Substances (unit : $\mu\text{g}/\text{m}^3$)	IARC	KOREA	CHINA	JAPAN (JAMA)	WHO	OEHHA REL * (US CA.GOV)		
							Acute	8-hours	Chronic
50-00-0	Formaldehyde	1	210	100	100	100	55	9	9
71-43-2	Benzene	1	30	110	-	-	27	3	3
75-07-0	Acetaldehyde	2B	-	50	48	50	470	300	140
100-41-4	Ethyl Benzene	2B	1,000	1,500	3,800	-	-	-	2,000
100-42-5	Styrene	2B	220	260	220	260	21,000	-	900
107-08-8	Acrolein	3	50	50	-	-	2.5	0.7	0.35
108-88-3	Toluene	3	1,000	1,100	260	260	37,000	-	300
1330-20-7	Xylene	3	870	1,500	870	-	22,000	-	700
Total			7 types	8 types	9 types*	-			

- JAPAN(JAMA) : Tetra decane $330 \mu\text{g}/\text{m}^3$, Di-n-butyl phthalate $220 \mu\text{g}/\text{m}^3$, Di-2-ethylhexyl phthalate $120 \mu\text{g}/\text{m}^3$
- OEHHA REL : Office of Environmental Health Hazard Assessment, Reference Exposure Levels(OEHHA.ca.gov)

◆ Agents Classified by the IARC Monographs

- Group 1 *Carcinogenic to humans* 117 agents
- Group 2A *Probably carcinogenic to humans* 74
- Group 2B *Possibly carcinogenic to humans* 287
- Group 3 *Not classifiable as to its carcinogenicity to humans* 503
- Group 4 *Probably not carcinogenic to humans* 1

CAS No.	Agent	Group*	Volume	Year	Additional information
50-00-0	Formaldehyde	1	Sup 7, 62, 88, 100F	2012	
71-43-2	Benzene	1	29, Sup 7. 100F	2012	
75-07-0	Acetaldehyde	2B	36, Sup 7, 71	1999	
100-41-4	Ethylbenzene	2B	77	2000	
100-42-5	Styrene	2B	60, 82	2002	
107-02-8	Acrolein	3	63, Sup 7	1995	
108-88-3	Toluene	3	47, 71	1999	
1330-20-7	Xylenes	3	47, 71	1999	

◆ Formaldehyde

OEHHA Toxicity Criteria Database

CAS Number: 50-00-0

Use(s): Disinfectant (antibacterial, fungicide), tissue fixative, photography (color negative stabilizer), textile treatment; precursor to polyfunctional alcohols; production of urea and melamine resins, phenolic resin, plastics, adhesives, preservatives, pressed wood products, automobile components; byproduct of combustion, component of tobacco smoke

Acute REL ($\mu\text{g}/\text{m}^3$): 55

Species: Human

Toxicologic Endpoint: Eye irritation

Target Organs: Eyes

Severity: Mild

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 9

Target Organs: Respiratory system

◆ Benzene

OEHHA Toxicity Criteria Database

CAS Number: 71-43-2

Use(s): Additive in gasoline, solvent, oil extraction, photogravure printing, veterinary medicine (disinfectant); production of detergents, explosives, pharmaceuticals, and dyestuffs; chemical intermediate in production of ethylbenzene (styrene), cumene, cyclohexane; component of combustion emissions and tobacco smoke

Acute REL ($\mu\text{g}/\text{m}^3$): 27

Species: Mouse

Toxicologic Endpoint: Reproductive/ development, aplastic anemia and acute myelogenous leukemia

Target Organs: Reproductive/ development, immune system, hematologic system

Severity: Severe

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 3

Target Organs: Hematologic system, nervous system, development

◆ Acetaldehyde

OEHHA Toxicity Criteria Database

CAS Number: 75-07-0

Use(s): Chemical intermediate in production of perfumes, resins, and dyes; fruit and fish preservative, flavoring agent, denaturant for alcohol; solvent; component of tobacco smoke

Acute REL ($\mu\text{g}/\text{m}^3$): 470

Species: Human

Toxicologic Endpoint: Respiratory and eye irritation

Target Organs: Respiratory system; eyes

8-Hour Inhalation REL ($\mu\text{g}/\text{m}^3$): 300

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 140

Target Organs: Respiratory system

◆ Ethylbenzene

OEHHA Toxicity Criteria Database

CAS Number: 100-41-4

Use(s): Styrene, synthetic rubber, airplane fuel; component of tobacco smoke

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 2,000

Target Organs: Development; alimentary system (liver); kidney; endocrine system

◆ Styrene

OEHHA Toxicity Criteria Database

CAS Number: 100-42-5

Use(s): Precursor to polystyrene and several copolymers; production of plastic, synthetic rubber, insulation and protective coatings, construction materials, vehicle components, food containers; flavoring agent; component of automobile and tobacco smoke

Acute REL ($\mu\text{g}/\text{m}^3$): 21,000

Species: Human

Toxicologic Endpoint: Respiratory and eye irritation

Target Organs: Respiratory system; eyes

Severity: Mild

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 900

Target Organs: Nervous system

◆ Acrolein

OEHHA Toxicity Criteria Database

CAS Number: 107-02-8

Use(s): Biocide: aquatic herbicide, fumigant, microbiocide, molluscide (considered an alternative to methyl bromide); preparation of biological specimens; component of tobacco smoke

Acute REL ($\mu\text{g}/\text{m}^3$): 2.5

Species: Human

Toxicologic Endpoint: Respiratory and eye irritation

Target Organs: Respiratory system; eyes

Severity: Mild

8-Hour Inhalation REL ($\mu\text{g}/\text{m}^3$): 0.7

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 0.35

Target Organs: Respiratory system

◆ Toluene

OEHHA Toxicity Criteria Database

CAS Number: 108-88-3

Use(s): Solvent, jet fuel component and gasoline additive, cement for polystyrene kits; production of polymers; chemical intermediate (benzene dealkylation); component of car exhaust and tobacco smoke

Acute REL ($\mu\text{g}/\text{m}^3$): 37,000

Species: Human

Toxicologic Endpoint: Reproductive/ development; headache, dizziness, sensory irritation

Target Organs: Reproductive/ development, nervous systems, respiratory system, eyes

Severity: Severe

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 300

Target Organs: Nervous system, respiratory system, development

◆ Xylenes

OEHHA Toxicity Criteria Database

CAS Number: 1330-20-7

Use(s): Solvent for paints, varnishes, inks, dyes, adhesives, pharmaceuticals, detergents, and rubber; production of polymer fiber (mylar and dacron); component of gasoline and fuel oils; component of tobacco smoke (m-,p-)

Acute REL ($\mu\text{g}/\text{m}^3$): 22,000

Species: Human

Toxicologic Endpoint: Central nervous system impairment, respiratory and eye irritation

Target Organs: Nervous systems, respiratory system, eyes

Severity: Mild

Chronic Inhalation REL ($\mu\text{g}/\text{m}^3$): 700

Target Organs: Nervous system, respiratory system, eyes

➤ Proposal : 8 substances

Formaldehyde (50-00-0), Benzene (71-43-2), Acetaldehyde (75-07-0), Ethylbenzene (100-41-4), Styrene (100-42-5), Acrolein (107-02-8), Toluene (108-88-3), Xylenes (1330-20-7)

➤ Rationale :

- There are many relevant substances with regard to Interior air quality and we can not cover all of the substances (e.g. VOCs, harmful substances)
- Harmonized test procedures for the measurement of interior VOCs taking into account existing standards, the 8 substances of VOCs emitted by interior materials used in the construction of vehicles will be considered to harmonize the test procedures.